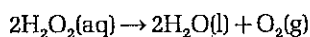


Catalysts

Hydrogen peroxide solution decomposes slowly at room temperature to form water and oxygen.



If the hydrogen peroxide is warmed the rate of decomposition increases.

The rate of decomposition can also be increased by adding a **catalyst**. Manganese(IV) oxide is a suitable catalyst for this reaction.

A catalyst is a substance which increases the rate of a chemical reaction without itself being consumed in the process.

The concentration of hydrogen peroxide solution is usually given as the volume of oxygen which can be obtained from 1 cm³ of the solution. For instance, 1 cm³ of a 20 volume solution of hydrogen peroxide produces 20 cm³ of oxygen.

Aim

To investigate the effect of various substances on the decomposition of hydrogen peroxide.

Apparatus and materials

Six test-tubes

Test-tube rack

Spatula

Splints

Hydrogen peroxide solution, 20 volume

Bunsen burner and mat

Manganese(IV) oxide

Copper(II) oxide

Zinc oxide

Potato slices

Sodium chloride

Sliced liver

Procedure

- 1 Add 20 volume solution of hydrogen peroxide to a test-tube to a depth of 1 cm.
- 2 Add one level spatula measure of manganese(IV) oxide to the hydrogen peroxide solution.
- 3 Observe the rate of production of oxygen. Award a mark out of 10 for the vigour of the bubbling.
- 4 Place a glowing splint into the top of the test-tube. Note whether the splint relights or not. If the oxygen escapes too quickly place a finger over the top of the test-tube to trap the

oxygen in the tube. Repeat the test with the glowing splint.

- 5 Repeat steps 1–4 with the other substances shown in the results table.
- 6 Place the substances tested in order of their ability to catalyse the decomposition of hydrogen peroxide.

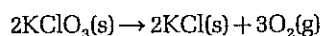
Results

Copy and complete the following table. Award a mark out of 10 for the rate at which oxygen is produced. Put them in order, highest mark first.

	rate of oxygen production (on scale 0–10)	order
manganese(IV) oxide		
copper(II) oxide		
zinc oxide		
sodium chloride		
potato slices		
sliced liver		

Questions

- 1 a) Describe the test for oxygen.
b) Although bubbles of oxygen are given off each time why does the test for oxygen sometimes fail?
c) Which two substances used in the experiment contain enzymes?
d) How would you recover the manganese(IV) oxide from the reaction mixture at the end of the experiment?
e) State another way, apart from using a catalyst, of increasing the rate at which hydrogen peroxide solution decomposes.
- 2 Manganese(IV) oxide catalyses the decomposition of potassium chlorate(V).



Both potassium chlorate(V) and potassium chloride (KCl) are white solids. Devise (**on paper**) an experiment to show that manganese(IV) oxide catalyses this decomposition.